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| EXAMINER | |
|---|---|
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/530,226 | UENSAL ET AL. | |
| | Examiner | Art Unit | |
| | HENRY S. HU | 1796 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *Election of November 20, 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) *25-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☒ Claim(s) *1 and 26* is/are objected to.

8)☒ Claim(s) *1-31* are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 August 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

**DETAILED ACTION**

1. This application **10/530,226** is filed according to 371/PCT/EP03/10905, which carries a foreign priority at October 4, 2002. It is noted that USPTO has received **three IDS'** (total 4 pages) and **two Pre-amendments** filed on so far. With such two pre-amendments, new **Claims 30-31** are added, while Claim 28 is only amended to change claim dependency.

This Office Action is in response to **Election** filed on November 20, 2008. **Applicant's election of Group I, Claims 1-24 is traversed with remarks on pages 1-2.** The traversal is on the ground(s) that it would not place an undue burden to search and examine the non-elected Group II (Claims 25-26) and Group III (Claims 27-31) with elected Group I since they are so closely related in the field of polymer electrolyte membrane/fuel cell. This is not found persuasive because **only the Examiner can determine the search burden**. Additionally, Group I is directed to **a proton-conducting polymer membrane**; Group II is directed to **an electrode**, while Group III is directed to **a membrane-electrode unit and a fuel cell comprising such a unit**. Although the subject matter from each group may comprise the same or at least similar polyazole blend or polymer coating, their structure, function and application are indeed quite different. They are thereby not equivalent and interchangeable.

2. **The structural elements are mutually exclusive and the search terms are also mutually exclusive, thus they indeed create an undue burden on the Examiner**. The

requirement is still deemed proper and is therefore made FINAL. **Claims 1-31** with **two** independent claims (**Claims 1 and 25**) are now pending, while non-elected Claims 25-26 (Group II) and Claims 27-31 (Group III) are withdrawn from consideration by the examiner. An action follows.

***Claim Objections***

3. **Claims 1 and 26 are objected to** because of the following informalities:

(a) On **Claim 1** at line 2, the vague language of "obtainable" is improper according to MPEP. A correction to "obtained" is needed. Otherwise, it is unclear whether it is actually obtained or not.

(b) On **Claim 26** at line 1, the claim dependency on "claim 24" is wrong. A correction to depend on "claim 25" is needed since it is related to electrode only.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. The limitation of parent **Claim 1** in present invention relates to ***a proton-conducting polymer membrane***, ***which comprises polyazole blends*** *and is obtainable by a process comprising* ***four*** *steps including:*

*(A)* ***preparation of a mixture*** *comprising* ***polyphosphoric acid, at least one polyazole (polymer A) and/or one or more compounds which are suitable for forming polyazoles*** *under the action of heat according to step (B),*

*(B)* ***heating*** *of mixture obtainable according to step (A) under inert gas to temperatures of up to 400°C,*

*(C)* ***application*** *of a layer using the mixture from step (A) and/or (B)* ***to a support****,*

*(D)* ***treatment*** *of the membrane formed in step (C)* ***until it is self-supporting****,*

*wherein at least one further polymer (polymer B) which is not a polyazole is added to the composition obtainable according to step (A) and/or step (B) and the weight ratio of polyazoles to polymer B is in the range from 0.1 to 50.*

*See other limitations of dependent* ***Claims 2-24****.*

6. **Claims 1-24 are rejected** under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. (US 2004/0062969 A1) in view of Cui et al. (US 6,869,980 B2).

Regarding "**proton-conducting polymer "blend"membrane**" limitation of parent **Claim 1**, **three** components are mixed for heating, then applying on substrate and finally forming a self-supporting membrane. The three components are: (A) a polyazole type polymer (or made from its precursor), and (B) a different polymer (other than polyazole type), and (C) polyphosphoric acid, wherein polymer (A) and polymer (B) will make a polymer blend according to the art.

7. Polyazole type polymer or such polyazole type polymer obtained from its precursors based on dependent **Claims 2-11** can be summarized to be polyimid**azole**, polybenzimid**azole**, polybenzothi**azole**, polybenzox**azole**, polytri**azole**, polyoxadi**azole**, polythiadi**azole**, polypyr**azole** and the like polymer. It is noted that open language "**comprising**" is applied to membrane composition and process of parent Claim 1.

8. **Sakaguchi** et al. has already prepared some proton-conducting electrolyte type "polymer membranes" (see paragraph 0001) to be particularly useful for making solid polymer electrolyte membrane/electrode assembly in **fuel cell operation**. Such a polymer membrane is achieved by first **dissolving polyazole type polymer in aprotic solvent such as polyphosphoric acid** (see paragraphs **0191, 0193, 0198 and 0225**; particularly see paragraph 0191 at lines 1-5 for

using polyazole polymers which are not containing any ionic functional group). See paragraphs 0203-0213 and working examples for the stepwise process of making such a membrane.

9. Therefore, **Sakaguchi** is "only" silent of adding the claimed polymer B (which is not polyazole type) to be useful as reinforcing polymer in making mambrane. **Cui** et al. has taught such a subject matter. For instance, **Cui** et al. has prepared some proton-conducting electrolyte type "polymer blend membranes", which is in **one single layer** (column 6, line 60-64; also see working examples) to be particularly useful for **fuel cell operation** (see title; abstract, line 1-7) by comprising **three** type polymers including: (A) **a functional polymer** which is a sulfonated aryl polymer (see column 3, line 27 – column 4, line 26), (B) **a reinforcing polymer** which is an aminated or nitrated polyether sulfone and/or polyether ether sulfone (see column 4, line 27 – column 5, line 67), and (C) a plasticizer which is a polymer such as linear type polyvinylidene fluoride (PVDF) (see column 6, line 5-33). By doing so, inexpensive membranes but still with sufficient performance properties in fuel cell operation can be obtained (column 1, line 23-29).

10. In light of the fact that both involving references are dealing with the making of proton-conducting membrane for fuel cell application and the proton exchange or proton conductivity is thereby the current key issue. Therefore, one having ordinary skill in the art would have found it obvious to modify **Sakaguchi**'s process of making the proton exchange membrane (PEMs) by using **adding some reforcing polymer** as taught by **Cui**. Therefore, inexpensive but still efficient fuel cell may be obtained.

11. Regarding **Claims 2-11**, various polyazole type polymers cited by Sakaguchi and Cui as well as the references cited therein read on limitations of Claims 2-11.

Regarding **Claims 12-18**, reinforcing polymers cited by Sakaguchi and Cui as well as the references cited therein read on limitations of Claims 12-18.

Regarding **Claims 19-24,** the conditions in making proton-conducting electrolyte type "polymer blend membranes" have been disclosed and/or at least suggested by the above-mentioned references in combination or alone.

12. **Claims 1-24 are rejected** under 35 U.S.C. 103(a) as being unpatentable over Cui et al. (US 6,869,980 B2) in view of **a combination of two** references including Matsuoka et al. (US 6,335,419 B2) and Calundann et al. (US 7,235,320 B2).

Regarding "**proton-conducting polymer "blend"membrane**" limitation of parent **Claim 1**, **three** components are mixed for heating, then applying on substrate and finally forming a self-supporting membrane. The three components are: (A) a polyazole type polymer (or made from its precursor), and (B) a different polymer (other than polyazole type), and (C) polyphosphoric acid, wherein polymer (A) and polymer (B) will make a polymer blend according to the art.

13. Polyazole type polymer or such polyazole type polymer obtained from its precursors based on dependent **Claims 2-11** can be summarized to be polyimid**azole**, polybenzimid**azole**, polybenzoth**iazole**, polybenzox**azole**, polytri**azole**, polyoxadi**azole**, polythiadi**azole**, polypyr**azole** and the like polymer. It is noted that open language "**comprising**" is applied to membrane composition and process of parent Claim 1.

14. **Cui** et al. has already prepared some proton-conducting electrolyte type "polymer blend membranes", which is in **one single layer** (column 6, line 60-64; also see working examples) to be particularly useful for **fuel cell operation** (see title; abstract, line 1-7) by comprising **three** type polymers including: (A) **a functional polymer** which is a sulfonated aryl polymer (see column 3, line 27 – column 4, line 26), (B) **a reinforcing polymer** which is an aminated or nitrated polyether sulfone and/or polyether ether sulfone (see column 4, line 27 – column 5, line 67), and (C) a plasticizer which is a polymer such as linear type polyvinylidene fluoride (PVDF) (see column 6, line 5-33). Cui further has disclosed that **phosphoric acid-doped polymer** such as **phosphoric acid doped polyazole type polymer** may be used to replace the above-mentioned **sulfonate group-functionalized aryl polymer** (column 1, line 36-52).

15. Therefore, Cui is "only" silent of using **polyphosphoric acid-doped polyazole type polymer** instead of using phosphoric acid doped polyazole type polymer. A combination of **two** references including **Matsuoka and Calundann** has taught such a subject matter as follows:

**Matsuoka** et al. has disclosed that polyazole type polymer can be prepared by a condensation type polymerization with the presence of a mixture of polyphosphoric acid and diphosphous pentaoxide. See column 5, line 26-55; column 6, line 55-60; also see working examples. By doing so, a film with improvement in tensile strength, elastic modulus and heat resistance can be thereby obtained by using such obtained **polyazole polymer, which is naturally doped with a mixture of polyphosphoric acid and phosphoric acid**. See column 1, line 10-31.

16. **Calundann** et al. teaches the reason why **phosphoric acid and the like acid-doped polyazole** as polymer electrolyte is useful for **fuel cell operation**. See title; abstract, line 1-6; column 1, line 49-51; column 2, line 22-23; column 5, line 4-10; column 12, line 59 – column 13, line 3. By doing so, such membrane based on polyazoles would display **an increased specific conductivity, in particular at operating temperatures above 100 °C, and additionally without humidification of fuel gas** (column 1, line 64 – column 2, line 3).

17. In light of the fact that all involving references are dealing with the making of proton-conducting membrane for fuel cell application and the proton exchange or proton conductivity is thereby the current key issue. Therefore, one having ordinary skill in the art would have found it obvious to modify Cui's process of making the proton exchange membrane (PEMs) by using **polyphosphoric acid/phosphoric acid-doped polyazole polymer** as taught by a combination of **two** references including **Matsuoka and Calundann**. A "membrane-like" film with improvement in tensile strength, elastic modulus and heat resistance as well as an

increased specific conductivity, in particular at operating temperatures above 100 °C, and additionally without humidification of fuel gas can be thereby obtained. Therefore, better and more efficient fuel cell may be obtained.

18. Regarding **Claims 2-11**, various polyazole type polymers cited by Cui, Matsuoka and Calundann as well as the references cited therein read on limitations of Claims 2-11.

Regarding **Claims 12-18**, reinforcing polymers cited by Cui, Matsuoka and Calundann as well as the references cited therein read on limitations of Claims 12-18.

Regarding **Claims 19-24,** the conditions in making proton-conducting electrolyte type "polymer blend membranes" have been disclosed and/or at least suggested by the above-mentioned references in combination or alone.

***Conclusion***

19. The prior art made of record and not relied upon is considered pertinent to applicants' disclosure. The following references relate to a proton-conducting polymer membrane, which comprises polyazole blends and is obtainable by a process comprising four steps as specified: **US 4,141,800 to Breuer** et al. only has disclosed the making of **multiple-layered membrane** to be useful as **filter membrane for gas detector**. Solid organic acid such as phenol-2,4-disulfonic acid is doped in the membrane in this purpose (see Table 2 at column 4, line 53—

column 5, line 7). **No polyphosphoric acid is applied at all**. Additionally, **no polyazole type polymer is mentioned**.

20. Any inquiry concerning this communication or earlier communication from the examiner should be directed to **Dr. Henry S. Hu whose telephone number is (571) 272-1103**. The examiner can be reached on Monday through Friday from 9:00 AM –5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Vasu Jagannathan, can be reached on (571) 272-1119. The **fax** number for the organization where this application or proceeding is assigned is **(571) 273-8300** for all regular communications. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D. Mulcahy/
Primary Examiner, Art Unit 1796

/Henry S. Hu/
Examiner, Art Unit 1796

February 27, 2009